An Abstract of M.Sc(Engg.) thesis
Variants of Hegselmann-Krause model

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July 15, 2015

The *Hegselmann-Krause system* (*HK system* for short) is one of the most popular models for the dynamics of opinion formation in multi agent systems. Agents are modelled as points in opinion space, and at every time step, each agent moves to the mass center of all the agents within unit distance. The rate of convergence of HK systems has been the subject of several recent works and the current best bounds are $O(n^3)$ in one dimension and $O(n^4)$ in higher dimension where n being the number of agents.

In this work, we investigate the convergence behaviour of a few natural variations of the HK system and their effect on the dynamics. In the first variation, we only allow pairs of agents who are friends in an underlying social network to communicate with each other and we can construct configurations. In the second variation, only one of the agents updates its position at each time step and selection of such an agent may be at random or based on some predefined order; as before, these updates of agents also take social information into consideration. In the third variant, agents may not move exactly to the mass center but somewhere close to it. In the fourth variant, we allow all agents to interact with one another, but instead of assigning equal weights to all neighbours as in the HK model, we assign gaussian weights which are inversely proportional to the distance between agents. In the fifth variant, we consider the Synchronised Bounded Influence model where the agents have influence bounds instead of confidence bounds, which changes the way agents interact with each other. In our final variant, we consider the dynamics of HK systems with strategic agents where we have an additional set of agents called as strategic agents whose opinions are chosen freely at each time step. One of the goals using these strategic agents is to lower the

convergence time.

The dynamics of all the variants are qualitatively very different from that of the classical HK system. Nevertheless, we prove convergence or show some other interesting results for all of these models. To be more specific, for the first and third variant we show that these systems make only polynomial number of non-trivial steps, regardless of the social network in the first variant and noise patterns in the third variant. For the second variant, however, we again show polynomial number of non-trivial steps but in expectation regardless of the social network and interestingly different dynamics. For the fourth variant, we prove an upper bound for the convergence time of gaussian weighted HK model. For the fifth variant, we consider a special case of this SBI model and prove convergence for this case. For the final variant, we improve the existing results for the optimal convergence time for *dumb-bell* and *equidistant* configurations.